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Publication date:
1993

Document Version
Publisher's PDF, also known as Version of record

WORC
Work and Organization Research Centre

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R3
- employees
- automation
- EU
- industries

PAPER

Demands, Control and Social Support and the Use of Computer Equipment among European Employees: A Comparison of Sectors of Industry

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WORC PAPER 93.12.028

Paper presented at the
Workshop on Stress in New Occupations
Tilburg, WORC, December 1-3, 1993

December 1993

ACKNOWLEDGMENT

This study is based on data from a survey by the European Foundation for the Improvement of Living and Working Conditions. The authors want to express their gratitude to the European Foundation for giving TNO the possibility to reanalyse the data.
This paper was written for the WORC Workshop on Stress in New Occupations, Tilburg, December 1-3, 1993

Demands, Control and Social Support and the Use of Computer Equipment among European Employees: A Comparison of Sectors of Industry.

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1. INTRODUCTION

The 'Service' sector is the largest sector in the European Community (E.C.). It is also a rapidly expanding sector. Almost 60% of the European work force (137 million workers) is employed in the 'Service' sector, either as self-employed or as an employed worker. The other sectors are 'Agriculture, forestry and fishing' (7.5%) and 'Industry' (34%). What does work in the 'Service' sector look like? Is it more or less stressful compared to other sectors? To what extent do employees consider it 'health threatening'? To what extent is the use of computer equipment common in the 'Service' sector and in other sectors? And, in the 'Service' sector, which are the more computerized branches? Are there important differences in stressors and strain between the main branches in the 'Service' sector, for instance between 'Transport & Communication' and 'Banking & Finance'? This paper tries to provide preliminary answers to these questions.

The European social dimension is growing in importance. This is illustrated by the introduction of the European Framework Directive on Health and Safety at the Workplace (De Gier et al. 1993). In Europe, though, comparative country studies on stress and working conditions are hardly available. Representative and comparable empirical data on the work situation of the EC-employees are lacking. Recently, however, a survey has been carried out on the work environment in the twelve EC countries (Paoli/European Foundation 1992). These countries are Belgium, Denmark, Greece, Spain, France, Ireland, Italy, Luxembourg, the Netherlands, Portugal, United Kingdom and Germany. West-Germany and the former East-Germany were treated as two countries. The survey sample (12,500 workers, both employees -80%- and self-employed -20%-) is representative for the distribution of the E.C. labour force over sectors, gender and age groups and professional status. This survey, firstly, shows in which sectors ('Agriculture etc.', 'Industry' and 'Services') and branches ('sub-sectors') employees in the

European Community are working (table 1). The figures apply to all 137 million workers in the European Community: 110 million employed and 27 self employed persons.

Table 1. *European Community Labour force breakdown per sector and branch. Source: Paoli (1992). Sectors are printed in italics.*

	SECTOR AND BRANCHES	Employed (millions)	%
1.	*Agriculture, forestry & fisheries*	*10.3*	*7.5%*
2.	*Industry*	*46.4*	*33.8%*
-	Energy, Steel, Extraction & Chemical industry	6.9	5.0%
-	Metal manufact., Mechanical & Electric industry (a.o. car industry, aerospace, ship building, electrical household appliances)	14.4	10.5%
-	Other manufacturing industry (a.o. food and drink industry, textile, leather and shoes, wood, paper, plastic and rubber)	14.7	10.7%
-	Building & Civil engineering (a.o. demolition work, building construction, civil engineering, building installation and completion)	10.4	7.6%
3.	*Service sector*	*80.4*	*58.6%*
-	Distributive trades & Catering (a.o. wholesale and retail distribution, hotels, restaurants, repairs of consumer goods and vehicles)	23.6	17.2%
-	Transport & Communication (a.o. railways, road and urban transport, sea and air transport, including supporting services)	9.6	7.0%
-	Banking & Finance (a.o. banking, insurance, real estate, renting services)	9.7	7.1%
-	Other services (a.o. public administration, social security, national defense, education, research, medical health services, cultural services)	37.5	27.4%
Total:		137.1	100%

Table 1 demonstrates that 10.3 million (7.5%) European employees are working in agriculture, forestry or in fisheries. A large number of these workers (7.3 million) is independent (self employed). Thirty-four percent are industrial workers, of which metal and other manufacturing industry being the largest industrial branches. In the service sector, with 58.6% of all employees the largest sector, the main branches are 'other services' (27%), a rather heterogenous category, and distributive trades and catering (17%).

2. QUESTIONS TO BE ANSWERED

Questions to be answered in this study are:

a. Does the 'Service' sector face more or other stressors and strains than other industrial sectors ('Agriculture, forestry and fisheries', and 'Industry')?

b. Do the four different branches in the 'Service' sector differ in the amount and nature of stressors and strains? These branches are:
   (1) Distributive trades, hotels, catering, repairs;
   (2) Transport and communications;
   (3) Banking and Finance, insurance, business services, renting;
   (4) Other services;

c. To what extent is the use of computer equipment common in different sectors and branches, especially in the 'Service' sector?

d. What are the characteristics of 'computerized work environments'?

3. METHODS

3.1 Data collection

The survey was carried out through direct face-to-face interviews in March/April 1991. The questionnaire was developed by a group of experts from various countries and representatives of trade unions and employer organizations at EC level (Paoli 1992). The sample consisted of 12.500 workers (1000 per country, except Luxembourg, 500). West- and East-Germany were seen as two countries, both with 1000 workers in the sample. The sample is representative of the E.C. work force distribution according to occupation, gender, age, sectors and company size (Paoli 1992).

3.2 Operationalization of the concepts

* First, new scales were developed in order to operationalize psychological job demands, job control and social support. Also scales were developed to study 'traditional blue

collar stressors', such as physical working conditions and physical work load. Furthermore length of work week, age of employee and gender were included. Every employee was given a scale score by summing up their scores on each of the questions and dividing this sum by the number of questions.

* Strain was operationalized as the positive answer to the question: 'Do you think your health or safety is at risk because of your work?'

* The use of computer equipment was operationalized as the answer to the question: 'Does your work involve using computer equipment?'

Table 2. *The single questions and the factors with their questions and their reliability coefficients, minimum and maximum scores*

1	*Computer use: Does your work involve using computer equipment?* (1, all the time; 7, never)
2	*Psychological Job Demands* (Alpha= .67): (1, all the time; 7, never)
	1. Does your work involve working at a very high speed?
	2. Does your work involve working to tight deadlines?
	3. Does your work involve carrying out short repetitive tasks?
3	*Job Control* (Alpha= .75): (1, yes; 2, no)
	1. Do you have the possibility to choose or change your order of tasks or your methods of work?
	2. Do you have the possibility to choose or change your speed or rate of work?
4	*Material and Social Job Support* (Alpha= .66): (1, yes, 2, no)
	1. In order to carry out your work, do you have clear and adequate information?
	2. In order to carry out your work, do you have sufficient training and experience?
	3. In order to carry out your work, do you have appropriate machines and tools?
	4. In order to carry out your work, do you have appropriate premises and furniture?
	5. In order to carry out your work, do you have sufficient support from superiors or colleagues?
5	*Physical Work Load* (Alpha= .65): (1, all the time; 7, never)
	1. Does your work involve painful or tiring positions?
	2. Does your work involve carrying or moving heavy loads?
6	*Physical Working Conditions* (Alpha= .68): (1, all the time; 7, never)
	1. When at work, are you exposed to noise so loud that you would have to raise your voice to talk to people?
	2. When at work, are you exposed to breathing in vapours, fumes, dust or dangerous substances?
	3. When at work, are you exposed to handling and/or touching dangerous substances or materials?
7	*Length of work week*: How many hours do you usually work per week? (1; < 5 hours; 14, > 66 hours)
8	*Age of the employee*: How old are you? (15; 65)
9	*Gender of the employee*: (1, male; 2, female)
10	*Health or safety risk*: Do you think your health or safety is at risk because of your work? (1, yes; 2, no)

3.3 Analysis

The questions were answered by means of descriptive statistics and analysis of variance (ANOVA, alpha = 0.001).

4. RESULTS

4.1 *Sectors and branches compared: stressors and strain*

In tables 3, 4 and 5 the 'stressor-strain profiles' of the three sectors and nine branches are presented. Table 3 presents the scores of the sectors 'Agriculture, forestry and fisheries', 'Industry' and 'Services'.

Table 4 concentrates on the industrial branche, whereas table 5 concentrates on the 'Service' sector, with its four branches. First differences were tested between the three sectors in table 3. Differences between sectors are significant with respect to all variables ($p < 0.001$). Next, differences were tested between the nine branches in tables 3, 4 and 5. Differences between branches are significant with respect to all variables ($p < 0.001$).

Table 3. 'Agriculture, forestry and fisheries', 'Industry' and 'Service' sector: a comparison of stressors and strain and some personal characteristics. The sector with the highest constraints is printed bold.

	Agriculture Forestry, Fisheries (n=566)	Total Industry (n=3014)	Total Service sector (n=6759)
Psych. job demands	4.75	**4.54**	5.09
Job control	1.28	**1.43**	1.35
Job support	**1.22**	1.13	1.14
Physical work load	**4.28**	5.31	5.80
Physical working conditions	**5.56**	**5.51**	6.27
Length of work week	**10.36**	8.36	8.08
Age	2.27	1.92	1.94
Gender	27%♀	24%♀	47%♀
Health or safety at risk	46%yes	35%yes	25%yes

Table 4. 'Industry' and industrial branches: a comparison of stressors and strain and some personal characteristics.

	Total Industry (n=3014)	Energy, Steel etc. (n=456)	Metal etc. (n=817)	Other Manufact. (n=1163)	Building Civil eng. (n=578)
Psych. job demands	4.54	4.64	4.63	4.49	4.42
Job control	1.43	1.42	1.42	1.48	1.38
Job support	1.13	1.12	1.13	1.13	1.15
Physical work load	5.31	5.71	5.47	5.31	4.74
Physical working conditions	5.51	5.42	5.48	5.57	5.53
Length of work week	8.36	8.39	8.31	8.27	8.57
Age	1.92	2.06	1.94	1.87	1.89
Gender	24%♀	20%♀	16%♀	38%♀	12%♀
Health or safety at risk	35%yes	37%yes	32%yes	32%yes	44%yes

Table 5. *Four branches in the Service sector: a comparison of stressors and strain and some personal characteristics. Branches with the highest constraints are printed bold.*

	Total Service Sector (n=6759)	Distributive Trades, Catering (n=1826)	Transport Communications (n=647)	Banking Finance (n=567)	Other Services (n=3719)
Psych. job demands	5.09	5.16	**4.54**	4.99	5.16
Job control	1.35	1.35	**1.50**	1.25	1.34
Job support	1.14	1.13	**1.16**	1.10	1.16
Physical work load	5.80	5.60	**5.48**	6.42	5.86
Physical working conditions	6.27	6.32	**5.82**	6.71	6.26
Length of work week	8.08	**9.08**	8.59	8.03	7.53
Age	1.94	1.87	1.98	1.84	1.97
Gender	47%♀	47%♀	18%♀	41%♀	53%♀
Health or safety at risk	25%yes	23%yes	42%yes	15%yes	25%yes

A general comparison between the three sectors in table 3 shows the highest psychological job demands in 'Industry'. Also job control is lowest in 'Industry'. Job support is lowest in 'Agriculture, forestry and fisheries', which is not surprising since this sector counts a lot of self employed workers. Physical work load and physical working conditions are most prominent in

'Agriculture etc.' and 'Industry'. The longest work week is in 'Agriculture etc.' In general, when compared with 'Agriculture, forestry and fisheries' and 'Industry', the 'Service' sector takes a more favorable position. This seems to be reflected in the amount of employees who consider their health and safety at risk: 25% in the 'Service' sector, against 35% in 'Industry' and even 46% in 'Agriculture, forestry and fisheries'. This relative favourable position does not imply that the 'Service' sector is a low strain sector, since one out of every four employees considers their health or safety at risk because of their work.

Table 4 demonstrates the highest level of strain in 'Building & civil engineering' (44%). In this branch also physical work load and phychological job demands are highest. Furthermore it can be noticed that the general industrial stressor-profile (table 3) also holds true for the four industrial branches, demonstrating serious psychosocial and physical stressors in each of the four industrial branches.

Table 5 permits a closer look at the 'Service' sector. Large differences are demonstrated between its four branches. The highest stressor-scores are found in 'Transport and Communications'. As to the psychosocial dimension, work in this branch is characterized by the combination of high psychological demands, low job control and low job support. This is a classical example of a stressful situation. In addition to these psychosocial work constraints there are also important 'blue collar' constraints related to the physical work load and physical working conditions. It is not surprising that a high percentage (41%) of the employees in this branch considers their health or safety at risk because of their work. Only in 'Agriculture, forestry and fisheries' and in 'Building & civil engineering' this strain score is higher.

Compared to 'Transport & Communications', the working conditions in the other 'Service' branches are more favourable. This is not to say that there are no stressful working conditions in these branches. Since a comparison of branches defines *relative* worse and better positions, better branches are not by definition good branches. In 'Distributive trades & Catering' the work week is the longest when compared to the other branches. There are some problems with the physical work load (27% reports working in painful positions at least 50% of the time'). Still twenty- three percent considers their health or safety at risk.

In the 'Banking and Finance' branch, work organization is characterized by well above average job control. Still there exist some psychosocial constraints: 34% of the employees work to tight deadlines at least 50% of the time, whereas 24% works to tight deadlines permanently. Nineteen

percent carries out short repetitive tasks (almost) all the time. As could be expected, physical work load and physical working conditions are regarded more favourable. This branch has the lowest percentage of employees who consider their health or safety at risk. Nevertheless this still relates to one out of every seven employees.

In the last branch, the rather heterogenous category 'Other Services', the work week is shorter when compared to the other branches. Although less when compared to the average E.C. score (39%) still a large group of employees in this branche (34%) is doing short repetitive work at least 34% of the time and also 34% is not able to change tasks or work method. The participation of women is high in this branch (53%).

4.2 The use of computer equipment

Table 6 demonstrates the use of computer equipment in the three sectors with their nine branches of industry.

Table 6. *The use of computer equipment in the sectors and branches of industry.*

Sector and branches	Mean	N
Agriculture, forestry & fisheries	*2.93*	*566*
Industry	*2.53*	*3014*
- Energy, Steel, Extraction & Chemical ind.	2.38	456
- Metal manufact., Mechanical & Electric ind.	2.41	817
- Other manufacturing industry	2.62	1163
- Building & Civil engineering	2.66	578
Service sector	*2.49*	6759
- Distributive trades & Catering	2.72	1826
- Transport & Communications	2.47	647
- Banking & Finance	1.69	567
- Other services	2.50	3719
Total	*2.53*	10,339

N.B. 1 = all the time; 7 = never.

There are large differences between the nine branches ((F(10336, 2) = 90.9; $p < 0.001$)).

The use of computer equipment is by far highest in 'Banking & Finance'. This branch is highly computerized (40% of the employees indicate permanent use of computer equipment). Next comes the industrial branch 'Energy, Steel, Extraction & Chemical industry'. Especially in the chemical industry many process operators work with modern tools.

As can be expected branches which least use computers are 'Agriculture, forestry & fisheries', 'Building and civil engineering' and 'Distributive trades & Catering'.

4.3 Work characteristics of computerized work environments

In order to further study work characteristics of computerized work environments, a division was made between employees whose work involves using computer equipment 'all the time' or 'almost all the time' or 'around 3/4 of the time' (n = 1710), 'around half the time' or 'around 1/4 of the time' (n = 1481), and a third group of employees who 'almost never' or 'never' use computer equipment (n = 7148). The scores of those groups with regard to the different stressors and strain are shown in Table 7.

Table 7 *Three groups of computer users: a comparison of stressors and strain and some personal characteristics. Groups with the highest constraints are printed bold. *: significant differences between computer groups, p < 0.001.*

	High computer use: 75%-100% (n=1710)	Medium computer use: 25%-50% (n=1481)	Non computer use: (almost) never (n=7148)	p < 0.001
Psychol.job demands	**4.56**	5.04	4.96	*
Job control	1.32	1.28	**1.40**	*
Job support	1.13	1.12	**1.15**	*
Physical work load	6.16	6.16	**5.31**	*
Physical work cond.	6.39	6.30	**5.88**	*
Lenght of workweek	8.15	8.16	**8.35**	*
Age	1.86	1.93	1.98	*
Gender	41%♀	38%♀	40%♀	n.s.
Health/safety at risk	20%	19%	33%	*

From table 7 it can be seen that there are many differences in stressors and strain between the three 'computer groups'. In general, the non users report more stressors when compared to the 'medium' and 'high' users. Non users report the least job control, the least material and social job support, the highest physical load, the worst physical working conditions and work the longest work week. Accordingly a relatively high percentage (33%) of those employees who (almost) never use computer equipment considers their health or safety at risk because of their work.

There are no important differences between the 'high' computer users and the 'medium' users, neither with respect to the stressors nor with respect to strain ('health or safety at risk'). There

is one important exception to this 'rule'. Those employees whose work mostly involves computer equipment (75-100% of the time) face the highest demands, in comparison to both the 'medium' and the 'non computer users'. In the 'high computer use group' 22% works at a very high speed (almost) all the time ('medium': 13%), 36% is working to tight deadlines (almost) all the time ('medium': 21%), and 25% carries out short repetitive tasks (almost) all the time ('medium': 12%).

5. DISCUSSION, CONCLUSIONS

5.1. The three sectors and the industrial branches: stressors and strain

Large differences in stressors and strain have been demonstrated between the three sectors and between the nine branches. A general comparison between the three sectors shows the highest psychological job demands and lowest job control in 'Industry'. Job support is lowest in 'Agriculture, forestry and fisheries'. Physical work load and physical working conditions are most prominent in 'Agriculture, forestry and fisheries' and 'Industry'. In comparison to 'Agriculture, forestry and fisheries' and 'Industry', the 'Service' sector takes a more favourable position. This seems to be reflected in the amount of employees who consider their health and safety at risk: 25% in the 'Service' sector, against 35% in 'Industry' and even 46% in 'Agriculture, forestry and fisheries'. This does not logically lead to the conclusion that the 'Service' sector has a low stressor-strain profile: still one out of every four employees considers his or her health or safety at risk due to the working situation.
Especially in the four industrial branches serious psychosocial and physical stressors have been demonstrated. The highest level of strain is in 'Building & civil engineering' (44%).

5.2. A closer look at the 'Service sector'

With respect to stressors and strain, the 'Service sector' is a very heterogenous sector. There are large differences between its four main branches: 'Distributive trades and Catering', 'Transport & Communications', 'Banking & Finance', and 'Other services', which is also a heterogonous branche in itself and needs a more detailed segmentation in future research. 'Transport & Communications' appears to be the most stressful branch. In terms of the 'Psychological

demands/decision latitude model' (Karasek & Theorell 1990), work in this branche is an example of 'high strain work', being characterized by a combination of high psychological demands, low job control and low job support. Furthermore, since there are also important blue collar stressors such as high physical work load, work in this branch can be regarded as an example of combined exposure (Van Dormolen et al. 1990).

The general picture in the other three branches is more favourable but still lists some major stressors in each of the branches, such as physical load ('Distributive trades and Catering'), time pressure ('Banking & Finance') and short cycled work and lack of autonomy ('Other services'). Also in those branches with a relatively favourable position, still at least 15% considers their health or safety at risk because of their work which regards several millions European employees.

5.3. The use of computer equipment and 'computerized' work environments

Computer use is by far highest in 'Banking & Finance'. Next comes 'Energy, Steel, Extraction & Chemical industry'. Since the use of computer equipment was subject of only one rather general question in this study, the answer 'yes' may relate to rather heterogenous working situations, ranging from the rather passive observation of complex production processes by a process operator in a large chemical plant to a rather dynamic staff position in a bank. In general, however, working with computers seems related to less stressors and strain when compared to non computer work, both with respect to the psychosocial dimensions job control and job support and with respect to 'traditional' physical stressors. Again this does not logically lead to the conclusion that stress is not a topic related to computer use. First, those employees whose work involves working with computers most frequently, also face the highest psychological demands: a very high speed, tight deadlines and short repetitive tasks. Secondly, still one out of every five employees among the 'high' and the 'medium' computer users considers their health and safety at risk because of their work.

It is tempting to interprete this 'stress profile' of the 'high' modern tools users in Table 7 (relative high demands in combination with relative high control and support) as an illustration of an 'active job' (Karasek & Theorell 1990). Active jobs provide challenging situations and high learning motivation to develop new behavior patterns. 'Such situations, while intensely demanding, involve workers in activities over which they feel a large measure of control, the freedom to use all available skills' (Karasek & Theorell 1990, p.35). In such jobs 'only average

psychological strain is predicted' (Karasek & Theorell 1990, p.36). The interpretation of high computer jobs as active jobs is tempting but seems somewhat premature since (1) the groups under study are formed on the basis of only one (computer use) item, (2) 25% of the 'high computer use employees' carries out short repititive tasks (almost) all the time and such monotonous tasks are in most cases not challenging, (3) the group with high computer use is of a heteregonous nature -computer use being highest in such differing branches as 'Banking & Finance' and 'Energy, Steel, Extraction & Chemical Industry'- and (4) also 'third' variables might play a role in explaining differences between computer use groups.

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